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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/017,573	12/13/2001	G. William Walster	SUN-P6445-SPL	8135

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EXAMINER	
DATSKOVSKIY, SERGEY	

ART UNIT	PAPER NUMBER
2121	

DATE MAILED: 10/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/017,573	WALSTER ET AL.	
	Examiner	Art Unit	
	Sergey Datskovskiy	2121	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 June 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *22-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *22-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 22-28 have been submitted for examination.

2. Claims 22-28 have been rejected.

Claim Objections

3. Claim 22 is objected to because of the following informalities: claim 22 recites the limitation "the optimizer" in line 16. There is insufficient antecedent basis for this limitation in the claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 22-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eldon Hansen's "Global Optimization Using Interval Analysis" (Hansen) in view of Michael J. Schulte et al., "A Variable-Precision Interval Arithmetic Processor" (Schulte).

Claim 22

Hansen teaches an computer system (page 3, paragraphs 7-9; page 4, paragraphs 1-4) for solving an interval global optimization problem (chapter 12)

specified by a function *f* (page 179, paragraph 1) and a set of equality constraints (page 179, paragraph 1), the computer system comprising:

a processing unit (it is inherent for a computer to contain a processing unit);

a memory (page 3, paragraphs 7-9; it is also inherent for a computer to include memory);

wherein computational code within the memory is configured to perform an interval global optimization process to compute guaranteed bounds on a globally minimum value of the function *f*(x) subject to the set of equality constraints (page 186, section 12.8, the steps of the algorithm);

wherein the optimizer is configured to, apply term consistency to the set of equality constraints over a subbox X, and to exclude portions of the subbox X that can be shown to violate any of the equality constraints (page 186, section 12.8, the steps of the algorithm).

Hansen does not expressly disclose an interval arithmetic unit within the processing unit, wherein the interval arithmetic unit is configured to receive floating-point numbers representing a first endpoint and a second endpoint for a first interval and floating-point numbers representing a first endpoint and a second endpoint for a second interval, and is configured to perform arithmetic operations to produce a first endpoint and a second endpoint representing a resulting interval;

However, Schulte teaches an interval arithmetic unit within the processing unit (page 248, abstract, paragraph 1), wherein the interval arithmetic unit is configured to

receive floating-point numbers representing a first endpoint and a second endpoint for a first interval and floating-point numbers representing a first endpoint and a second endpoint for a second interval (page 249, last paragraph, operations with two intervals are disclosed in page 252, paragraph 2), and is configured to perform arithmetic operations (page 252, paragraph 2) to produce a first endpoint and a second endpoint representing a resulting interval (page 249, paragraph 2: "*Interval arithmetic represents each result by two interval endpoints...*");

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the computer system for solving an interval global optimization problem from Hansen and combine it with the interval arithmetic unit from Schulte for the benefit of increasing speed of numeric computations (Hansen, page 4, lines 7-11; Schulte, page 249, paragraph 4). Therefore, it would have been obvious to modify Hansen in view of Schulte by using an interval arithmetic unit in the computer system for solving an interval global optimization problem.

Claim 23

Hansen teaches the computer-system of claim 22.

However, Hansen does not expressly teach that the interval arithmetic unit includes a first input, wherein the first input includes a first floating point number representing a lower bound of the first input and a second floating point number representing an upper bound of the first input; and wherein the interval arithmetic unit includes a second input, wherein the second input includes a third floating point number

representing a lower bound of the second input and a fourth floating point number representing an upper bound of the second input.

Schulte teaches that the interval arithmetic unit (page 248, abstract, paragraph 1) includes a first input, wherein the first input includes a first floating point number representing a lower bound of the first input and a second floating point number representing an upper bound of the first input (page 249, last paragraph); and wherein the interval arithmetic unit includes a second input, wherein the second input includes a third floating point number representing a lower bound of the second input and a fourth floating point number representing an upper bound of the second input (page 249, last paragraph, operations with two intervals are disclosed in page 252, paragraph 2).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the computer system for solving an interval global optimization problem from Hansen and combine it with the interval arithmetic unit from Schulte using the same motivation as in claim 22 above.

Claim 24

Hansen teaches the computer-system of claim 22, wherein the optimizer is configured to: precondition the set of equality constraints through multiplication by an approximate inverse matrix B to produce a set of preconditioned equality constraints; apply term consistency to the set of preconditioned equality constraints over the subbox X; and to exclude portions of the subbox X that can be shown to violate any of the

preconditioned equality constraints (page 186, section 12.8, the steps of the algorithm. Also see an example in chapter 12.6, pages 184-185).

Claim 25

Hansen teaches the computer-system of claim 22, wherein the optimizer is configured to: keep track of a least upper bound *f_bar* of the function f(x); unconditionally remove from consideration any subbox for which *inf*(f(x))>*f_bar*; apply term consistency to the inequality f(x) ≤ *f_bar* over the subbox X; and to exclude portions of the subbox X that violate the inequality (page 186, section 12.8, the steps of the algorithm, in particular, step 2).

Claim 26

Hansen teaches the computer-system of claim 22, wherein the optimizer is configured to: apply box consistency to the set of equality constraints $q_i(x) = 0$ (i=1, ...,r) over the subbox X; and to exclude portions of the subbox X that violate the set of equality constraints (page 186, section 12.8, the steps of the algorithm).

Claim 27

Hansen teaches the computer-system of claim 22, wherein the optimizer is configured to: evaluate a first termination condition; wherein the first termination condition is TRUE if a function of the width of the subbox X is less than a pre-specified value, ε_X, and the absolute value of the function, f, over the subbox X is less than a pre-

specified value, ε_F; and to terminate further splitting of the subbox X if the first termination condition is TRUE (page 186, section 12.8, the steps of the algorithm, in particular, steps 16-18. Also see page 99, chapter 87 describing box reduction: "*When it is sufficiently reduced, we do not split it. Instead, we try to reduce it further by reapplying the algorithm to it*").

Claim 28

Hansen teaches the computer-system of claim 22, wherein the optimizer is configured to perform an interval Newton step on the John conditions (page 186, section 12.8, the steps of the algorithm, and specifically, step 14).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Bethany et al. (US Patent No. 3,900,723) teaches an apparatus for controlling computer pipelines for arithmetic operations on vectors. Kulisch (US Patent No. 4,622,650) teaches circuitry for generating scalar products and sums of floating point numbers with maximum accuracy. Yoshihara (US Patent No. 5,253,327) teaches an optimization apparatus. Smith (US Patent No. 6,049,865) teaches a method and apparatus for implementing floating point projection instructions. Steele (US App. No. 2002/0184283) teaches a floating point system with improved support of interval arithmetic. Suzuki et al. (US Patent No. 6,718,289) teaches a processing apparatus and method for solving optimization problem).

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sergey Datskovskiy whose telephone number is (571) 272-8188. The examiner can normally be reached on Monday-Friday from 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anthony Knight, can be reached on (571) 272-3687. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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